

ZOOLOGY.—*Thysanopoda spinicaudata*, a new bathypelagic giant euphausiid crustacean, with comparative notes on *T. cornuta* and *T. egregia*. EDWARD BRINTON, Scripps Institution of Oceanography,¹ La Jolla, Calif. (Communicated by Fenner A. Chace, Jr.)

The bathypelagic giant euphausiids are taken here to include Crustacea belonging to the order Euphausiacea which live planktonically at great depths in the ocean, commonly below 2,000 meters. These giants among euphausiids are little known, probably owing to the fact that they are not abundant and live below the range of sampling of ordinary plankton-collecting gear. It is also possible that they are fast swimmers and are able to escape most nets. Together with *Thysanopoda spinicaudata*, n. sp., described below, the group includes at present only *Thysanopoda cornuta* Illig, 1905, and *T. egregia* Hansen, 1905. These euphausiids comprise a subdivision, "Group B," of the genus *Thysanopoda*, which was observed by H. J. Hansen (1912) to constitute a morphologically related unit. Four characters define this unit: a well-developed cervical groove separates the head area of the carapace from the thoracic region; the pseudoexopod of the first maxilla scarcely overreaches the outer margin of the joint, or does not overreach it at all; the endopod of the first maxilla is very long; the sixth abdominal somite is shorter than the fifth.

Euphausiids of this group are readily distinguished from other euphausiids, especially by means of the short sixth abdominal somite. Among the other species of Euphausiacea, only *Thysanopoda cristata* G. O. Sars, a midwater form which appears to be closely related to the giant euphausiids, possesses a sixth abdominal somite which is nearly as short as the fifth.

The euphausiids which live above a depth of about 500 meters are relatively small in size, reaching a maximum length of about 20 mm. There are two exceptions: the Antarctic *Euphausia superba* Dana which sometimes attains a length of 60 mm, and *Meganyctiphanes norvegica* (M. Sars) of the North Atlantic which reaches 40 mm. The euphausiids of the upper strata include

numerous species belonging to nine genera, including one species *T. aequalis* Hansen, of Hansen's "Group A" of *Thysanopoda*.

The population which normally inhabits waters between about 500 and 2,000 meters is characterized by fewer genera and species, and by somewhat larger euphausiids. The largest of these, which sometimes attain a length of 50 mm, are *Thysanopoda acutifrons* Holt and Tattersall, and *T. cristata* G. O. Sars, both of which belong to Group A of *Thysanopoda*, and the monospecific *Bentheuphausia amblyops* (G. O. Sars).

The typical euphausiids below 2,000 meters are the bathypelagic giant euphausiids which belong to Group B of *Thysanopoda*. *Bentheuphausia*, and some other species whose major concentration is in upper layers, may, however, be present in this deep zone from time to time. The largest specimen in the Scripps Institution collections of the bathypelagic giant *T. egregia* is an adult female 62 mm long; the female specimen of *T. spinicaudata* measures 84 mm, and the largest known specimen of *T. cornuta*, a male collected by the Scripps Institution vessel *Horizon* in the southeastern Gulf of Alaska, is 95 mm long. These euphausiids not only attain a somewhat greater length than the Antarctic surface form *Euphausia superba*, but are also more broad. It is of interest to note, however, that both *E. superba* and the bathypelagic giant euphausiids inhabit waters which are colder than 2-3°C.

It has been necessary to describe *T. spinicaudata* from a single specimen. This is felt to be justified in view of the extreme scarcity of animals of this group. *T. egregia* Hansen (1905), was described from a single specimen captured near the insular slope of the Madeira Islands, while *T. cornuta* Illig (1905), was described from one animal from the Wallfisch Ridge of the Southeastern Atlantic. Illig (1905, 1930) and Hansen (1905, 1915) figure some of the features of *T. cornuta*, while Hansen (1905) has drawn the anterior part of *T. egregia*.

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son, under whose supervision a study of the Pacific euphausiids is being carried out, for his criticism and suggestions.

Thysanopoda spinicaudata, n. sp.

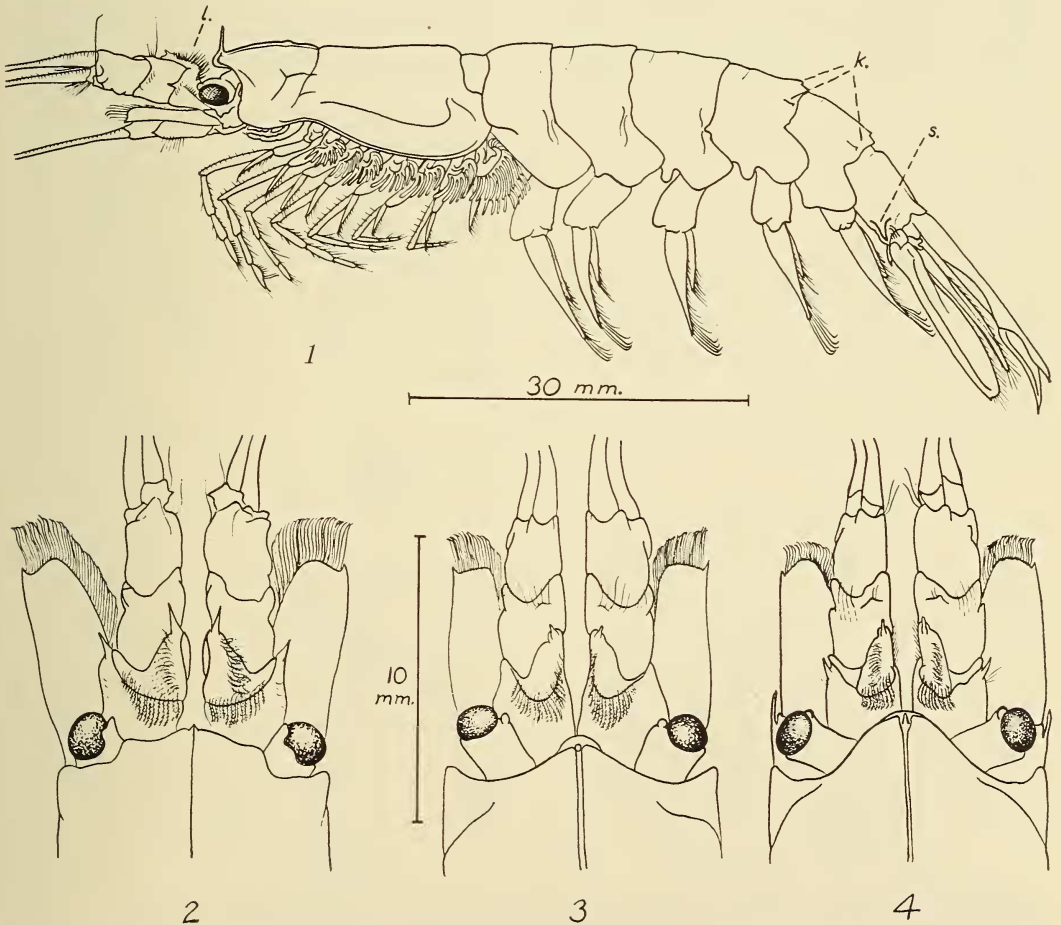
Figs. 1, 3, 6, 10, 11

Holotype.—Female; length 84 mm.

Diagnosis.—The carapace is without lateral denticles in the adult. A cervical groove crosses the dorsal part of the carapace. Lateral furrows (Fig. 1) are continuous with the cervical groove. A longitudinal submarginal ridge extends along the lateral margin of the carapace posterior to the subvertical grooves. The lateral limits of the carapace are thickened to form marginal ridges. Viewed dorsally (Fig. 3), the anterior margin of the carapace is slightly convex. The dorsal an-

terior end of the frontal plate is armed with a strong vertical spine 1.4 mm in length. A low middorsal keel is present on the carapace, extending from the vertical spine to the cervical groove. The keel is interrupted near its midpoint by a short, obtuse prominence. Viewed laterally, the thickness of the frontal plate is less than the length of the dorsal spine. The anterior margins of the frontal plate, lateral to the spine, are slightly upturned.

The proximal end of the lower flagellum of the first antenna carries a dense tuft of long, colorless setae. The heavily setose, raised dorsal area of the first article of the peduncle of the first antenna (Fig. 1, 3) is equipped terminally with an acute tooth which is bulbous at its base and which is directed upward and laterally. The setose



FIGS. 1-4.—1, *Thysanopoda spinicaudata*, adult female: k, Keels on fourth and fifth abdominal somites; l, lappet on first article of antennular peduncle; s, spine on sixth abdominal somite. 2, *T. egregia*, anterior region, dorsal view. 3, *T. spinicaudata*, anterior region, dorsal view. 4, *T. cornuta*, anterior region, dorsal view.

part of the lappet of the first article is not produced posteriorly beyond its point of junction with the main part of the article; hence it does not overhang the trunk of the article. The scale of the second antenna is truncated distally (Fig. 3). A denticle is present at the antero-lateral angle.

T. spinicaudata derives its name from a heavy spine which is directed posteriorly and laterally from each side of the sixth abdominal somite (Fig. 1, s.). This spine originates a short distance forward of the posterior margin of the somite and, together with that part of the pleuron adjacent to it, is situated so as to serve as a protective socket for the articulated base of the uropod.

The pleura of the second abdominal segment are very slightly produced at the anterolateral angle, while those of the third and fourth segments are distinctly lobed. The pre-anal spine curves upward distally. Viewed laterally (Fig. 6),

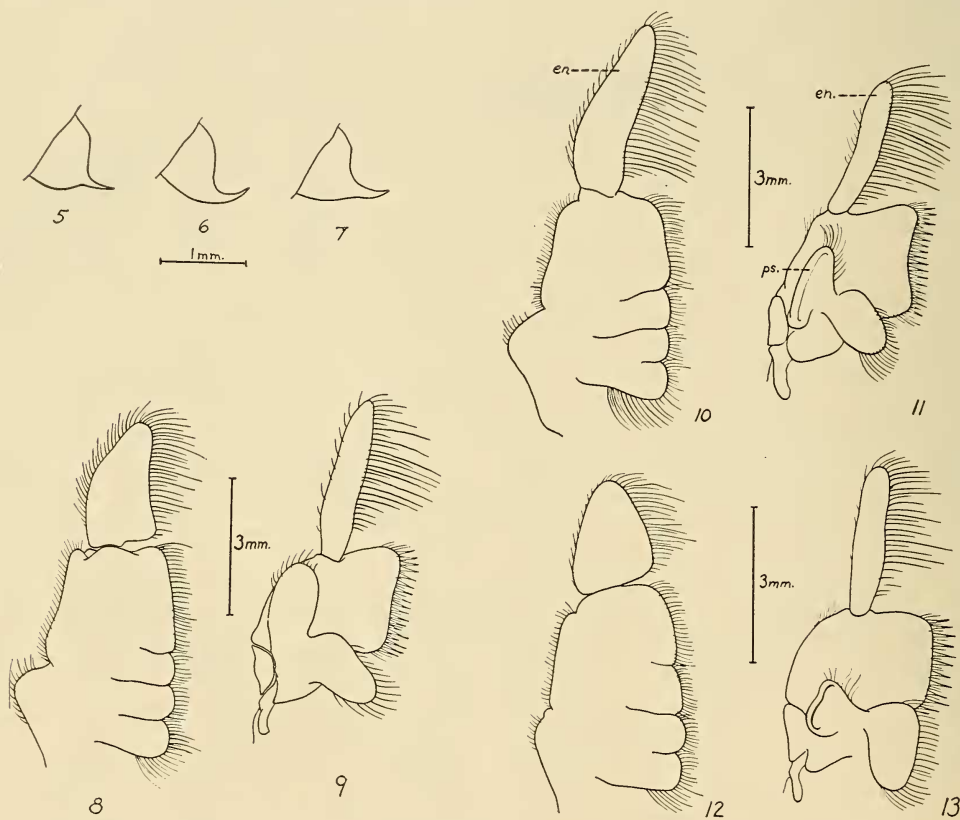
its lower margin traces a simple arc from the base of the spine to the acute tip.

The endopod of the first maxilla (Fig. 11) is slightly convex in outline along its inner longitudinal border and concave on its outer margin. The pseudoexopod of the first maxilla bears no indentation on its slightly thickened outer margin. The endopod of the second maxilla is very elongate (Fig. 10). The terminology for the mouthparts is that employed by Hansen (1925).

T. spinicaudata is brilliant red in color except for black eyes; white, richly arborescent gills, and tufts of fine, colorless setae at the bases of the outer flagella.

Type specimen.—The type specimen is deposited in the U. S. National Museum, no. 95677.

Remarks.—The frontal plate of this proposed new species is not produced anteriorly to the extent that it is in *T. cornuta* (Fig. 4), nor is it so obtuse, when viewed dorsally, as in *T. egregia*.



FIGS. 5-13.—5, *Thysanopoda cornuta*, pre-anal spine. 6, *T. spinicaudata*, pre-anal spine. 7, *T. egregia*, pre-anal spine. 8, *T. cornuta*, left second maxilla. 9, *T. cornuta*, left first maxilla. 10, *T. spinicaudata*, left second maxilla. 11, *T. spinicaudata*, left first maxilla; *en.*, endopod; *ps.* pseudoexopod. 12, *T. egregia*, left second maxilla. 13, *T. egregia*, left first maxilla.

A small tubercle, comparable to but much smaller than the dorsal spine of *T. spinicaudata*, is present on the frontal plate of *T. cornuta*. Seen laterally, the thickness of the frontal plate of *T. cornuta* is much greater than the length of the tubercle. The frontal plate of *T. egregia* is curved downward. The middorsal keel on the carapace of *T. cornuta*, anterior to the cervical groove, is higher and more massive than in *T. spinicaudata*, while in *T. egregia* it is lower, broader, and poorly defined.

The proximal end of the lower flagellum of the first antenna of the males of *T. cornuta* and *T. egregia* is much thicker than that of the females of these two species and of *T. spinicaudata*. However, in each of the species the end carries a tuft of long setae which is more dense in males of *T. cornuta* and *T. egregia* than in females.

In *T. cornuta* and *T. egregia* the setose lappet of the first article of the peduncle of the first antenna is produced posteriorly, and slightly overhangs the trunk of the article. In the same two species, the distal margin of the scale of the second antenna is convex, when viewed dorsally (Figs. 2, 4), while in *T. spinicaudata* it is obtuse or truncated.

The fourth and fifth abdominal somites in all three species each bear three abbreviated keels: a mid-dorsal keel, flanked by a pair of subdorsal keels (Fig. 1). The posterior dorsal surface of the sixth somite is hollowed, forming a dorsolateral ridge along each side of the posterior half of the somite.

The ventral margins of the pre-anal spines of *T. egregia* and *T. cornuta* are indented (Figs. 5, 7), while in *T. spinicaudata* this margin is convex. The spines in the two former species show no sexual dimorphism.

Distinctions between these allied species are found also in details of mouthpart structure. The pseudoexopod of the first maxilla of *T. egregia* (Fig. 13) is, as in *T. spinicaudata*, slightly thickened along its outer margin. It is also indented near the midpoint of that margin, while the same margin of the pseudoexopod of *T. spinicaudata* is entirely convex. The pseudoexopod of the first maxilla of *T. cornuta* (Fig. 9) is flat and reaches to the outer margin of its joints.

The endopod of the second maxilla of *T. egregia* (Fig. 12) and of *T. cornuta* (Fig. 8) is half again as long as it is wide. The entire margin is

convex in outline in *T. egregia*, while the inner margin of the same endopod of *T. cornuta* is concave in profile.

Larvae tentatively assigned to *T. cornuta* by Illig (1930) and Zimmer (1914) possess spiniform processes at the subdorsal posterior margins of the sixth abdominal somites. Compared with the latero-ventral spines which are subterminal to the sixth segment of *T. spinicaudata*, these are dorsolaterally situated and are present only in the larval (fureilia) stages of *T. cornuta*. The Scripps collections contain a series of the larvae which have the spiniform processes. Observations upon the development of the lateral groove complex on the carapace and of the tubercle on the frontal plate of the carapace indicate that these larvae belong to *T. cornuta*.

Type locality and collecting gear.—*T. spinicaudata* was collected by use of the Isaacs-Kidd Midwater Trawl at 2,200 meters in 4,070 meters of water, between 25°52'N, 114°40'W, and 26°00'N, 114°24'W. This is 75 miles west of the Baja California continental slope, adjacent to the southern shoulder of Rosa Bank.

Distribution.—*T. cornuta* and *T. egregia* have been taken at depths of 1,100–6,000 meters in the Atlantic, Pacific, and Indian Oceans. Larvae are known from 150–1,500 meters. *T. spinicaudata*, taken at 2,200 meters, probably has ecological requirements similar to those of the other two species. Extensive sampling in the North-eastern Pacific by Scripps Institution vessels indicates that the giant forms occur in deep waters seaward of continental shelves and borderland areas.

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ZOOLOGY.—*On the ranges of certain crayfishes of the Spiculifer group of the genus Procambarus, with the description of a new species*¹ (Decapoda: Astacidae). HORTON H. HOBBS, Jr., University of Virginia. (Communicated by Fenner A. Chace, Jr.)

Six species of crayfishes belonging to the Spiculifer group of the genus *Procambarus* are known to inhabit lotic situations in Alabama, Florida, Georgia, and South Carolina. Of these, three have been described: *P. spiculifer* (LeConte, 1856:401), *P. versutus* (Hagen, 1870:51), and *P. suttkusi* Hobbs (1953:173). A description of the fourth is given below; however, before those of the other two are made larger series of both are needed.

Plotted on the accompanying map are the locality records available for the four described species. Since *P. spiculifer* and *P. versutus* are known from so many localities, a listing of the localities from which they have been collected seems superfluous; however, exact locality data have been given for *P. suttkusi* and are listed for the species described below.

The greatest gap in our knowledge lies in the region of the middle Chattahoochee and in the Alabama River system. It will be noted from map 1 that *P. spiculifer* is known from headwater streams of the Alabama River in Georgia as well as from localities near its mouth, but whether it occurs in the region between is not known. Specimens of *P. spiculifer* from over its entire known range have been examined rather carefully, but variations are few, and in no place where adequate series are available do any of these variations seem to be confined to local populations. A study of variations in *P. versutus* has been deferred until more specimens from central Alabama become available.

¹ Contribution from the Samuel Miller Biological Laboratories. I wish to thank Dr. E. C. Raney and Dr. D. C. Scott for their kindness in collecting for me the specimens on which this description is based, as well as for those on which many of the locality records indicated on the map are established.

Genus *Procambarus* Ortmann (1905)

Procambarus raneyi,² n. sp.

Diagnosis.—Rostrum with lateral spines and without a median carina; areola relatively broad and short (about four times as long as broad and about 28 per cent of entire length of carapace); two lateral spines on each side of carapace. Male with hooks on ischiopodites of third and fourth pereopods; palm of chela of first form male not bearded but bearing a row of 7 to 9 tubercles along mesial margin. Post-orbital ridges terminate cephalad in spines. First pleopod of first form male (Figs. 1 and 3) without a shoulder on cephalic margin and terminating distally in three distinct parts. Mesial process subspiculiform and directed caudodistad; cephalic process absent (as in *P. spiculifer*); caudal element consists of a small corneous curved tooth lying at the caudal base of the central projection; the compound central projection, the most conspicuous of the terminal elements, beaklike, corneous, and with its tip directed caudad; as is usual the centrocephalic process is much larger than the centrocaudal one. Annulus ventralis partially hidden by tuberculate extensions from the sternum anterior to annulus (Fig. 2).

Holotypic male, form I.—Body subovate, somewhat compressed laterally; abdomen slightly shorter than carapace (53.2-55.2 mm). Height and width of carapace in region of caudodorsal margin of cervical groove subequal; greatest width of carapace a little cephalad of caudodorsal margin of cervical groove (25.3 mm).

Areola relatively broad and short, about 4.4

² I name this species in honor of my good friend Dr. Edward C. Raney, of Cornell University, who has so graciously donated to me large numbers of crayfishes which he has collected while studying the fishes in the eastern part of the United States. Without his aid our knowledge of the crayfishes of the Atlantic slope would have been considerably hampered.